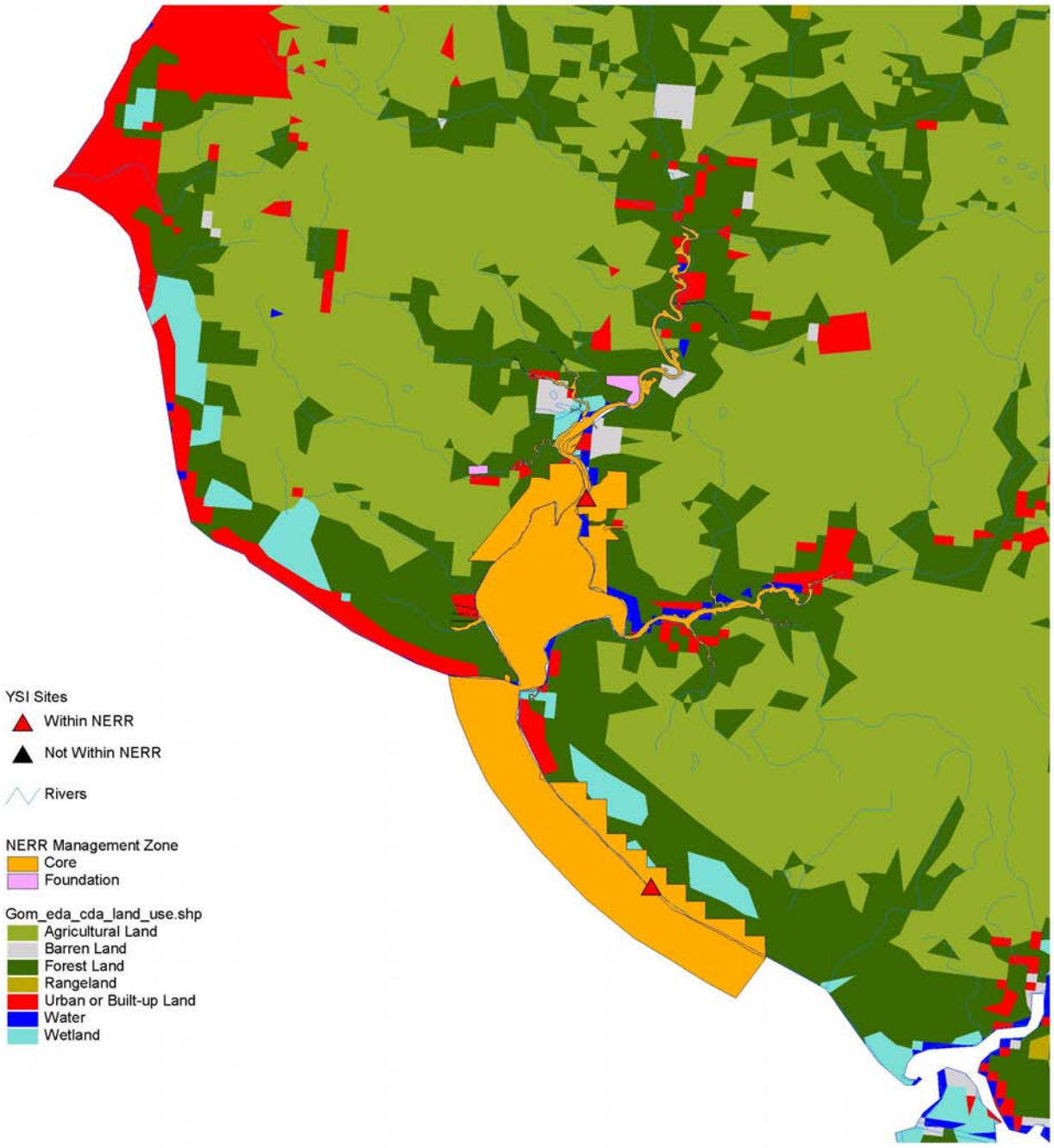
Weeks Bay


YSI Sites
Within NERR
Not Within NERR
Rivers
NERR Management Zone
Core
Foundation
Gom_eda_cda_land_use.shp
Agricultural Land
Barren Land
Forest Land
Rangeland
Urban or Built-up Land
Water
Wetland

Weeks Bay, Fish River (WKBFR)

Characterization (Latitude = 30°24'58"N; Longitude = 87°49'22"W)
Tides at the Fish River site are diurnal and range from 0.2 m to 0.6 m (average 0.4 m). The monitoring site is located at the mouth of Fish River. Fish River is 46 km long (mainstream linear dimension), has an average depth of 3 m MHW, and an average width of 150 m. At the sampling site, the depth is 2 m MHW and the width is 120 m. Creek bottom habitats are predominantly sandy-silt, with *Vallisineria* sp. growing near the monitoring site. The dominant marsh vegetation near the sampling site is *Spartina cynosuroides*. The dominant upland vegetation includes *Pinus taeda* and *Magnolia virginiana*. Upland land use near the sampling site includes some residential use. Activities that potentially impact the site include high non-point source nutrient loading and increased sedimentation due to disturbed soil caused by new home construction sites.

Descriptive statistics
Seventy-five deployments were made at this site between Jan 1996 and Dec 1998, with equal coverage during all seasons (Figure 185). Mean deployment duration was 13.8 days. Five deployments (Aug and Dec 1996, Apr and May 1997, and Jan 1998) were less than 10 days.

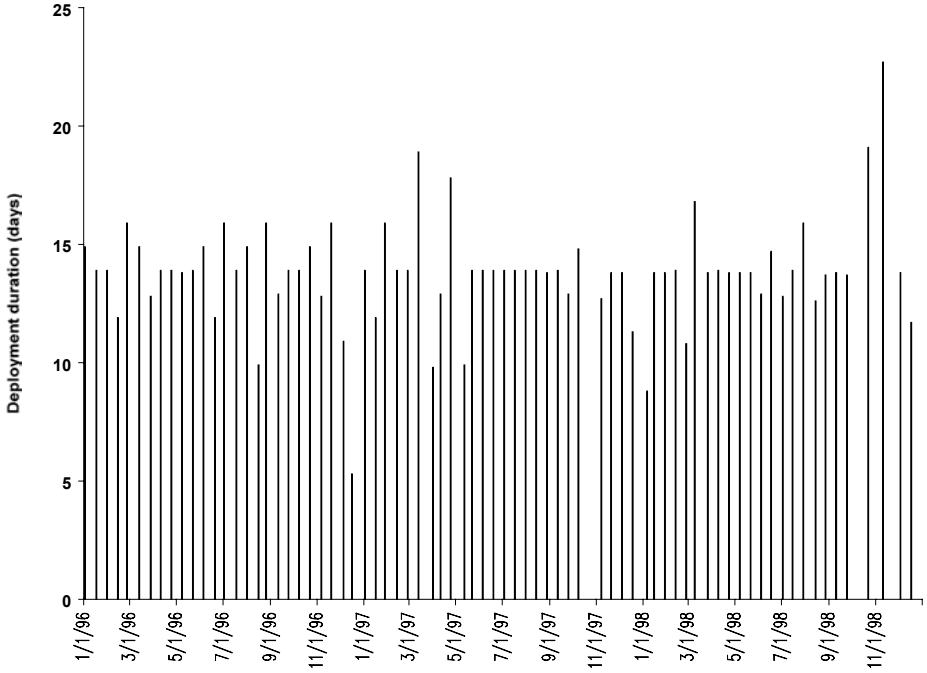


Figure 185. Weeks Bay, Fish River deployments (1996-1998).

Ninety-five percent of annual depth data were included in analyses (97% in 1996, 94% in 1997 and 1998). Sensors were deployed at a mean depth of 1.9 m below the water surface and 0.5 m above the bottom sediment. Scatter plots suggest moderate depth fluctuations (0.5 – 0.7 m) in summer (except for Jun 1997 and Sep 1998) and strong depth fluctuations (~ 1 m) throughout the remainder of the year. Harmonic regression analysis attributed 82% of depth variance to interaction between 12.42 hour and 24 hour cycles, 16% of variance to 24 hour cycles, and 2% of depth variance to 12.42 hour cycles.

Ninety-five percent of annual water temperature data were included in analyses (97% in 1996, 94% in 1997 and 1998). Water temperature followed a seasonal cycle, with mean water temperature 13-15°C in winter and 28-30°C in summer (Figure 186). Minimum and maximum water temperature between 1996-1998 was 6.2°C (Feb 1996) and 33.7°C (Aug 1998), respectively. Decline in mean water temperature in fall 1997 was more abrupt than in fall 1996 and fall 1997. Scatter plots suggest moderate fluctuations (≤ 3°C) in daily water temperature and strong fluctuations (3-8°C) in bi-weekly water temperature throughout the data set, with strongest fluctuations (8-14°C) observed during episodic events in winter 1996 and 1997. Harmonic regression analysis attributed 70% of temperature variance to interaction between 12.42 hour and 24 hour cycles, 25% of temperature variance to 24 hour cycles, and 5% of temperature variance to 12.42 hour cycles.

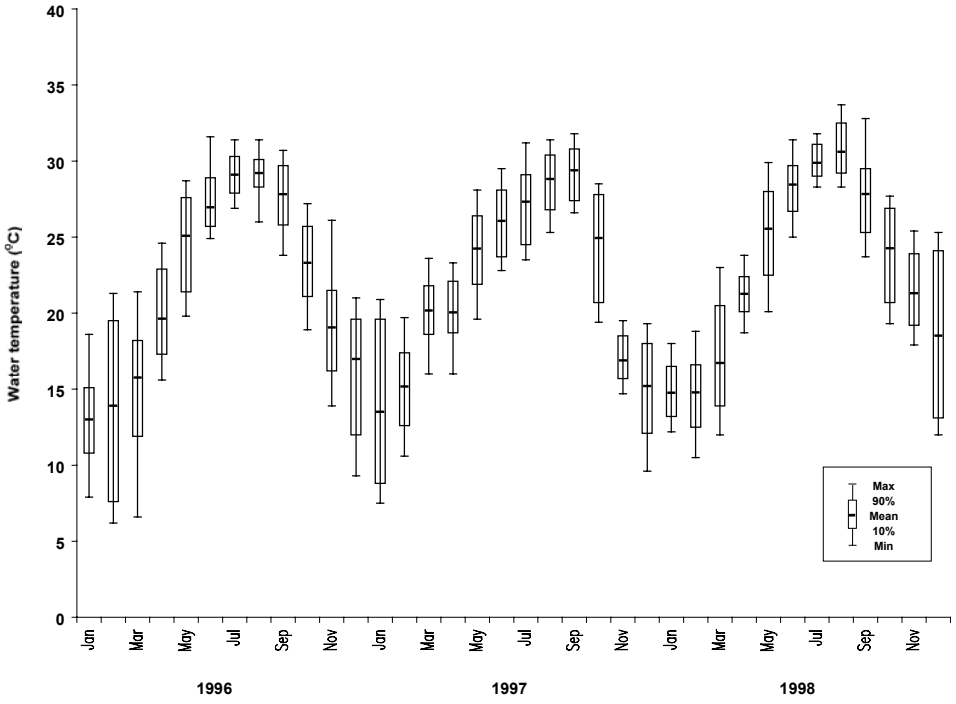


Figure 186. Water temperature statistics at Fish River, 1996-1998.

Ninety-four percent of annual salinity data were included in analyses (97% in 1996, 94% in 1997, and 90% in 1998). Mean salinity followed a seasonal cycle (Figure 187). Mean salinity was greatest in summer and fall (7-13 ppt) and least in winter and spring (0-3 ppt). Minimum salinity regularly approached 0 ppt in winter and spring. Maximum salinity was 17.6 ppt (Oct 1997). Scatter plots suggest daily and bi-weekly salinity fluctuations equivalent to, or in excess of, seasonal ranges in salinity (3 ppt for winter/spring, 6 ppt for summer/fall) throughout the data set except for Apr-Jun 1996, Jun-Jul 1997, and Jan-Jun 1998. Harmonic regression analysis attributed 75% of salinity variance to interaction between 12.42 hour and 24 hour cycles, 19% of salinity variance to 24 hour cycles, and 6% of salinity variance to 12.42 hour cycles.

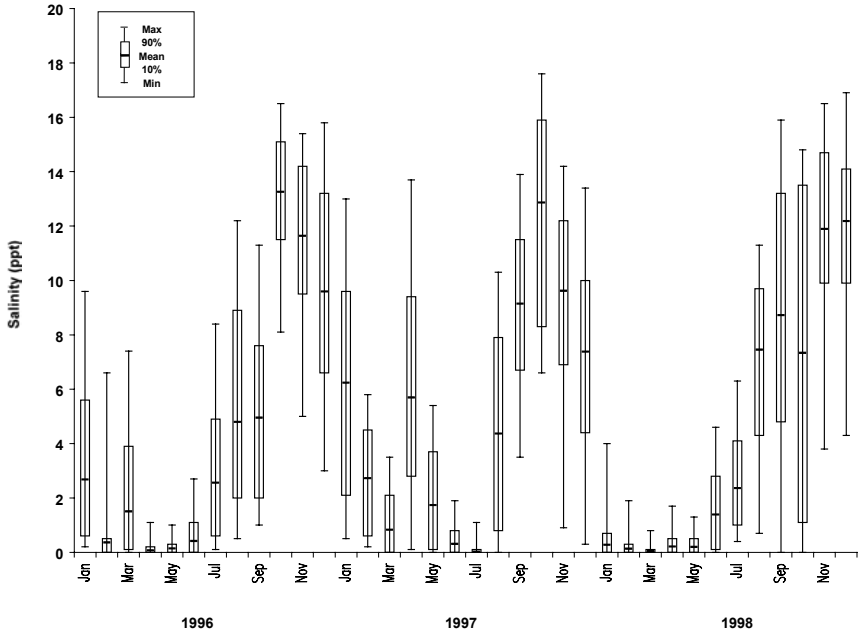


Figure 187. Salinity statistics at Fish River, 1996-1998.

Eighty-two percent of annual dissolved oxygen (% saturation) data were included in analyses (92% in 1996, 91% in 1997, and 63% in 1998). Mean DO was 52-113% saturation throughout the data set, except for Sep 1997 when mean DO was 36% saturation. Mean DO was greatest in fall, winter, and spring (78-113% sat) and least in summer (36-79% sat). Hypoxia was observed in Jan and Sep 1997 and persisted for 39.2% and 1.5% of the first 48 hours post-deployment, respectively (Figure 188). Supersaturation was regularly observed in 1996, less frequently observed in 1997, and infrequently observed in 1998. When present, supersaturation persisted for 14% of the first 48 hours post-deployment on average. Scatter plots suggest moderate fluctuations (20-80%) in percent saturation in winter and spring 1996, summer 1997, and winter and spring 1998. Strong fluctuations (80-180%) in percent saturation were observed in summer and fall 1996, winter, spring and fall 1997, and fall 1998. Harmonic regression analysis attributed 62% of DO variance to interaction between 12.42 hour and 24 hour cycles, 28% of variance to 24 hour cycles, and 10% of DO variance to 12.42 hour cycles.

Photosynthesis/Respiration

Over three quarters (78%) of the data used to calculate the metabolic rates fit the basic assumption of the method (heterogeneity of water masses moving past the sensor); however, instrument drift was a problem at this site. There was a significant difference in total respiration rates between the first 2 days of the deployment and the total length of the deployment. Because of this only the first 2 days of each deployment (12% of the observations) were used to estimate net production, gross production, total respiration and net ecosystem metabolism (Table 36). Total respiration exceeded gross production at Fish River; thus, the net ecosystem metabolism and P/R ratio indicated that this was a heterotrophic site (Figure 189). Temperature was not significantly ($p<0.05$) correlated with any metabolic measurement. Salinity was significantly ($p<0.05$) correlated with gross production and net ecosystem metabolism. Gross production decreased as salinity increased, while net ecosystem metabolism became more autotrophic as salinity increased.

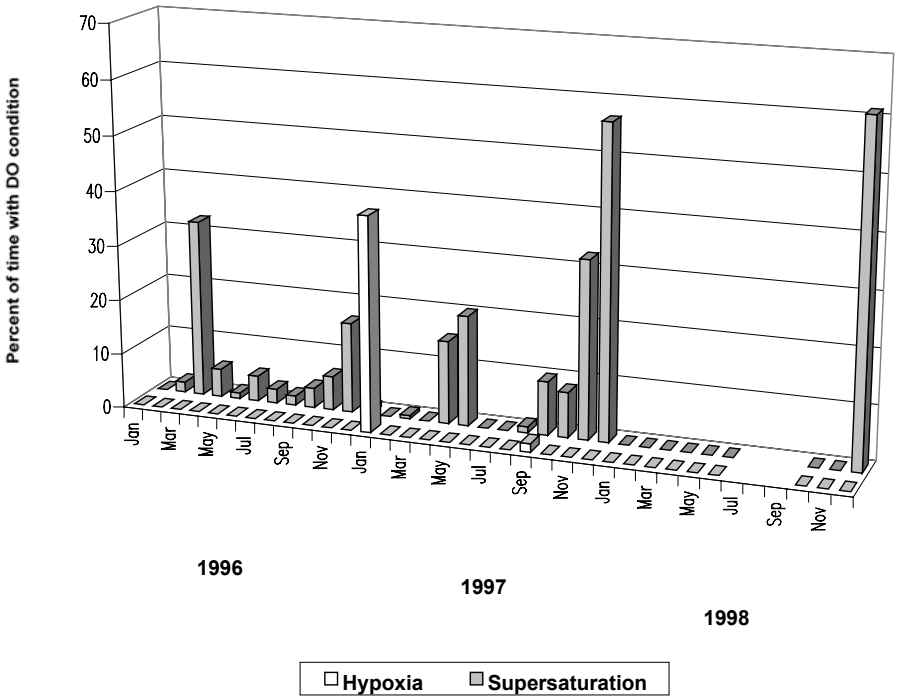


Figure 188. Dissolved oxygen extremes at Fish River, 1996-1998.

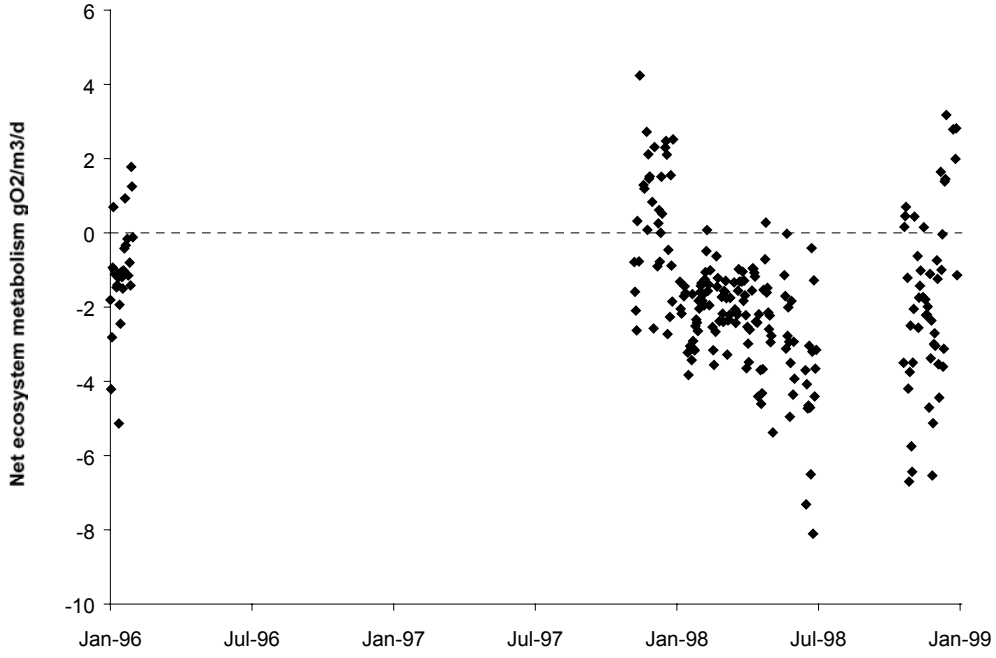


Figure 189. Net metabolism at Fish River, 1996-1998.

Table 36. Summary of metabolism data and statistics at Fish River, 1996-1998.

Fish River	mean	s.e.
Water depth (m)	2.0	
Net production $gO_2/m3/d$	0.54	0.24
Gross production $gO_2/m3/d$	1.54	0.22
Total respiration $gO_2/m3/d$	2.40	0.21
Net ecosystem metabolism g $O_2/m3/d$	-0.86	0.24
Net ecosystem metabolism g C/m2/y	-129	
P/R	0.64	
Statistical results		
Drift – paired t-test		
Gross production	p = 0.002	
Total respiration	p = 0.02	
Net ecosystem metabolism	ns	
Percent useable observations	78 %, 12 %	
Paired t-test on gross production and total respiration	p < 0.001	
Correlation coefficient	Temperature	Salinity
Gross production	ns	0.37
Total respiration	ns	ns
Net ecosystem metabolism	ns	0.38

Weeks Bay, Weeks Bay (WKBWB)

Characterization (Latitude = 30°22'51"N; Longitude = 87°49'58"W)
Tides at Weeks Bay site are diurnal and range from 0.2 m to 0.6 m (average 0.4 m). The monitoring site is located near the southeastern shore of Weeks Bay, about 0.5 km from the mouth of the estuary. The bay is 3.4 km long (mainstream linear dimension), has an average depth of 1.4 m MHW, and an average width of 1500 m. At the sampling site, the depth is 0.9 m MHW and the width is 400 m. Creek bottom habitats are predominantly sand-silt, with no submerged aquatic vegetation. The dominant marsh vegetation near the sampling site (0.5 km away) is *Spartina alternifolia*. The dominant upland vegetation includes *Quercus virginiana* and *Pinus taeda*. Upland land use near the sampling site is almost exclusively residential development, with some agriculture inland. Activities that potentially impact the site include non-point source nutrient loading, and increased sedimentation due to disturbed soil caused by new home construction sites.

Descriptive statistics
Seventy-two deployments were made at this site between Jan 1996 and Dec 1998, with equal coverage during all seasons (Figure 190). Mean deployment duration was 14.3 days. Only three deployments (Apr 1997, Sep 1997, Jan 1998) were less than 10 days.

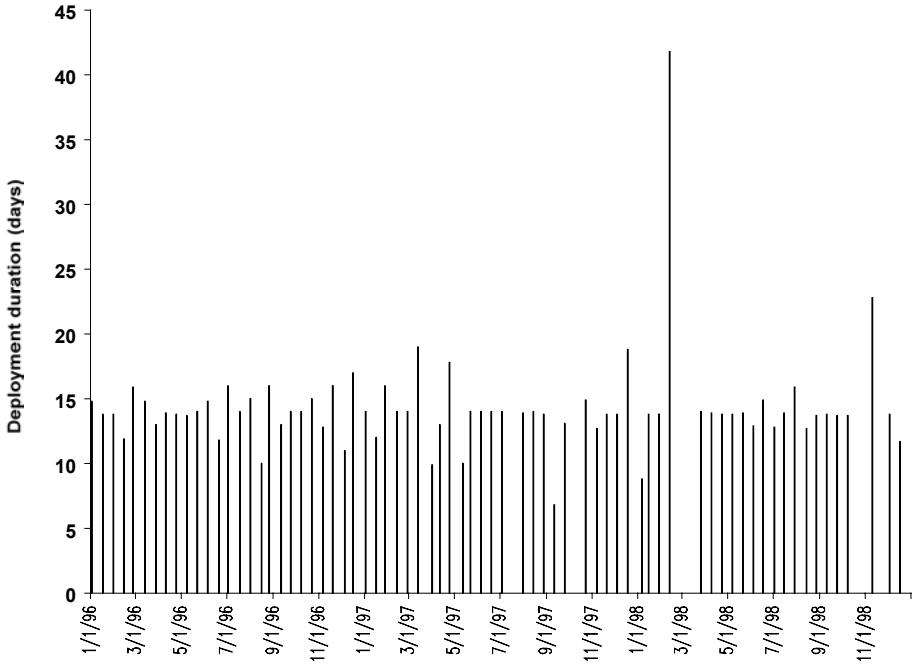


Figure 190. Weeks Bay, Weeks Bay deployments (1996-1998).

Ninety-one percent of annual depth data were included in analyses (99% in 1996, 86% in 1997 and 1998). Sensors were deployed at a mean depth of 0.6 m below the water surface and 0.5 m above the bottom sediment. Scatter plots suggest moderate fluctuations (≤ 1 m) in daily and bi-weekly depth readings throughout the data set, except for Sep 1998 when depth fluctuated almost 2 m. Harmonic regression analysis attributed 79% of depth variance to interaction between 12.42 hour and 24 hour cycles, 20% of depth variance to 24 hour cycles, and 1% of depth variance to 12.42 hour cycles.

Ninety-one percent of annual water temperature data were included in analyses (99% in 1996, 86% in 1997 and 1998). Mean water temperature followed a seasonal cycle, with typical water temperatures 13-15°C in winter and 28-31°C in summer (Figure 191). Minimum and maximum water temperature between 1996-1998 was 1.6°C (Feb 1996) and 35.4°C (Jul 1998), respectively. Scatter plots suggest moderate fluctuations (1-3°C) in daily water temperature and strong fluctuations (3-6°C) in bi-weekly water temperature throughout the data set, with strongest fluctuations (6-14°C) in bi-weekly water temperatures during episodic events in fall and winter. Harmonic regression analysis attributed 49% of temperature variance to interaction between 12.42 hour and 24 hour cycles, 47% of temperature variance to 24 hour cycles, and 4% of temperature variance to 12.42 hour cycles.

Ninety-one percent of annual salinity data were included in analyses (99% in 1996, 86% in 1997 and 1998). Mean salinity followed a seasonal cycle, with typical salinity 2-6 ppt in winter and spring and 10-15 ppt in summer and fall (Figure 192). Minimum salinity between 1996-1998 regularly approached 0 ppt in winter and spring. Maximum salinity between 1996-1998 was 22 ppt (Nov 1996). Scatter plots suggest strong variance in bi-weekly salinity equivalent to, or in excess of, annual variation in mean salinity in winter, summer, and fall 1996, all of 1997 except Jun and Jul, and all of 1998 except for Mar and Apr. Harmonic regression analysis attributed 65% of salinity variance to

interaction between 12.42 hour and 24 hour cycles, 30% of salinity variance to 24 hour cycles, and 5% of salinity variance to 12.42 hour cycles.

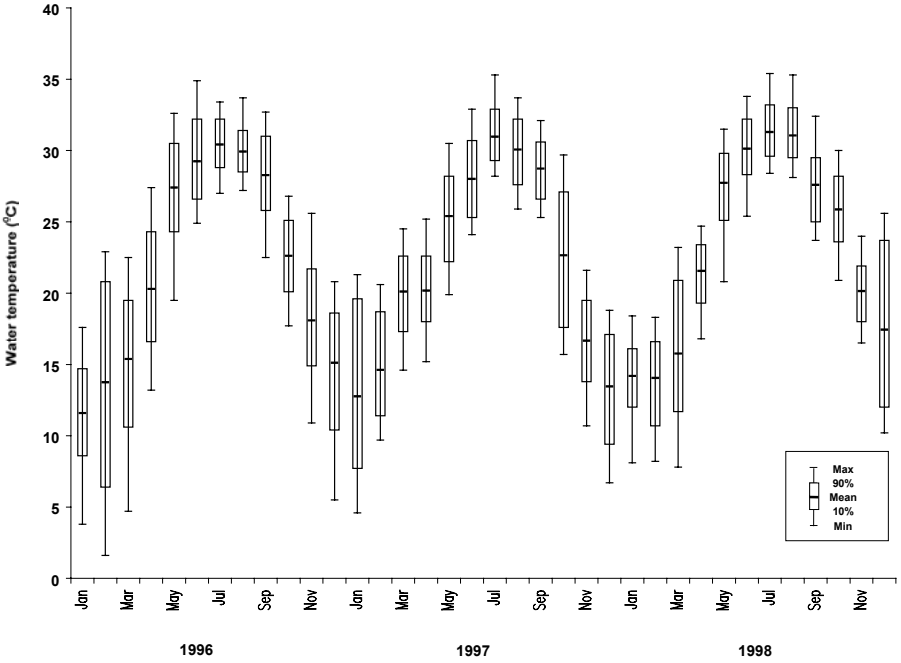


Figure 191. Water temperature statistics at Weeks Bay, 1996-1998.

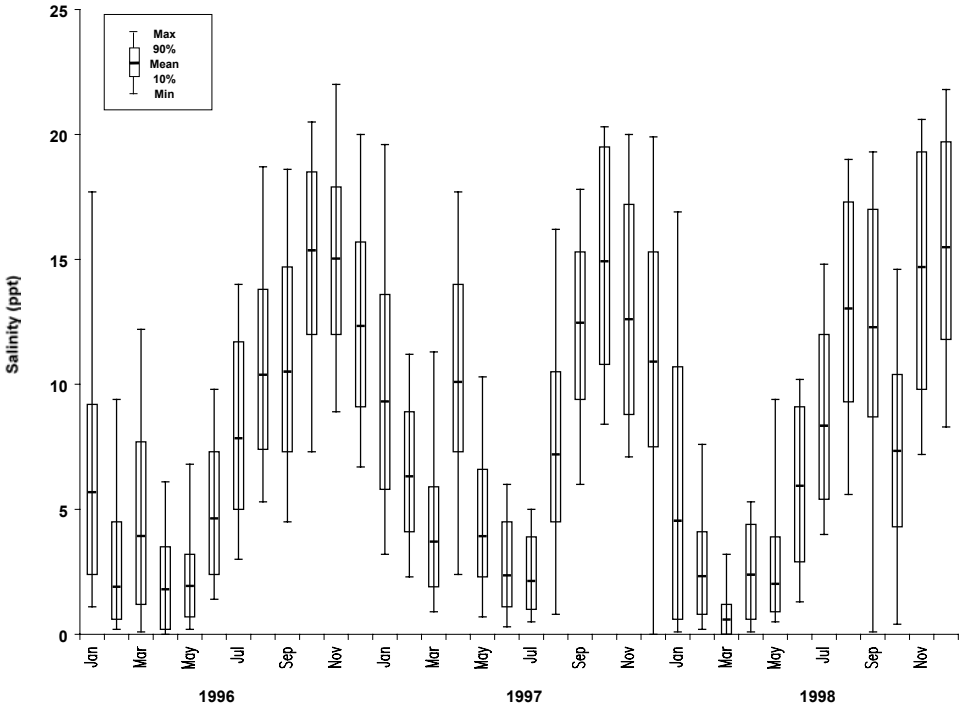


Figure 192. Salinity statistics at Weeks Bay, 1996-1998.

Seventy-six percent of annual dissolved oxygen (% saturation) data were included in analyses (88% in 1996, 74% in 1997, and 67% in 1998). Mean DO was 60-117% saturation throughout the data set, except for Jul (34% sat) and Nov-Dec (127-136% sat) 1997. Mean DO was greatest in winter, spring, and fall (67-136% sat) and least in summer (34-93% sat). Minimum and maximum DO between 1996-1998 was 0% saturation (Apr, Jun-Jul 1997) and 193.7% saturation (Jun 1998), respectively. Persistent hypoxia was never observed, but supersaturation was regularly observed (Figure 193). Scatter plots suggest moderate fluctuations (40-80%) in percent saturation in winter 1996 and 1998, with strong fluctuations (80-180%) throughout the data set. Harmonic regression analysis attributed 60% of DO variance to interaction between 12.42 hour and 24 hour cycles, 32% of DO variance to 24 hour cycles, and 8% of DO variance to 12.42 hour cycles.

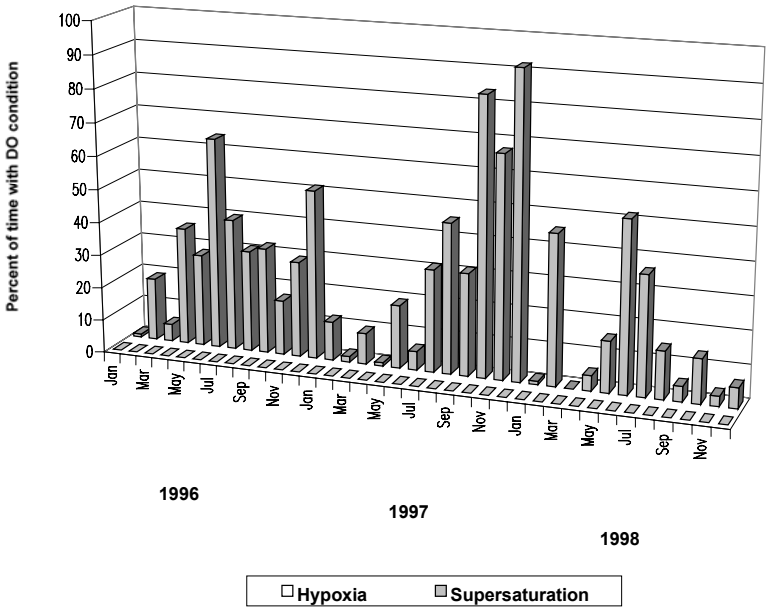


Figure 193. Dissolved oxygen extremes at Weeks Bay, 1996-1998.

Photosynthesis/Respiration

Three quarters (75%) of the data used to calculate the metabolic rates fit the basic assumption of the method (heterogeneity of water masses moving past the sensor) and was used to estimate net production, gross production, total respiration and net ecosystem metabolism (Table 37). Total respiration exceeded gross production at Weeks Bay; thus, the net ecosystem metabolism and P/R ratio indicated that this was a heterotrophic site (Figure 194). Temperature was significantly ($p<0.05$) correlated with gross production and total respiration. Gross production increased as temperature increased, while net ecosystem metabolism became more heterotrophic as temperature increased. Salinity was significantly ($p<0.05$) correlated with net ecosystem metabolism. Net ecosystem metabolism became more heterotrophic as salinity increased. Thus, the metabolic rates generally followed a seasonal pattern with the lowest rates during the winter when temperature and salinity were low and the highest rates during summer months, although summer rates could be highly variable.

Table 37. Summary of metabolism data and statistics at Weeks Bay, 1996-1998.

Weeks Bay	mean	s.e.
Water depth (m)	1.3	
Net production $gO_2/m3/d$	1.31	0.29
Gross production $gO_2/m3/d$	3.62	0.48
Total respiration $gO_2/m3/d$	4.3	0.48
Net ecosystem metabolism g $O_2/m3/d$	-0.78	0.32
Net ecosystem metabolism g C/m2/y	40	
P/R	0.84	
Statistical results		
Drift – paired t-test		
Gross production	ns	
Total respiration	ns	
Net ecosystem metabolism	ns	
Percent useable observations	75 %	
Paired t-test on gross production and total respiration	$p < 0.001$	
Correlation coefficient	Temperature	Salinity
Gross production	0.68	ns
Total respiration	0.64	ns
Net ecosystem metabolism	ns	-0.33

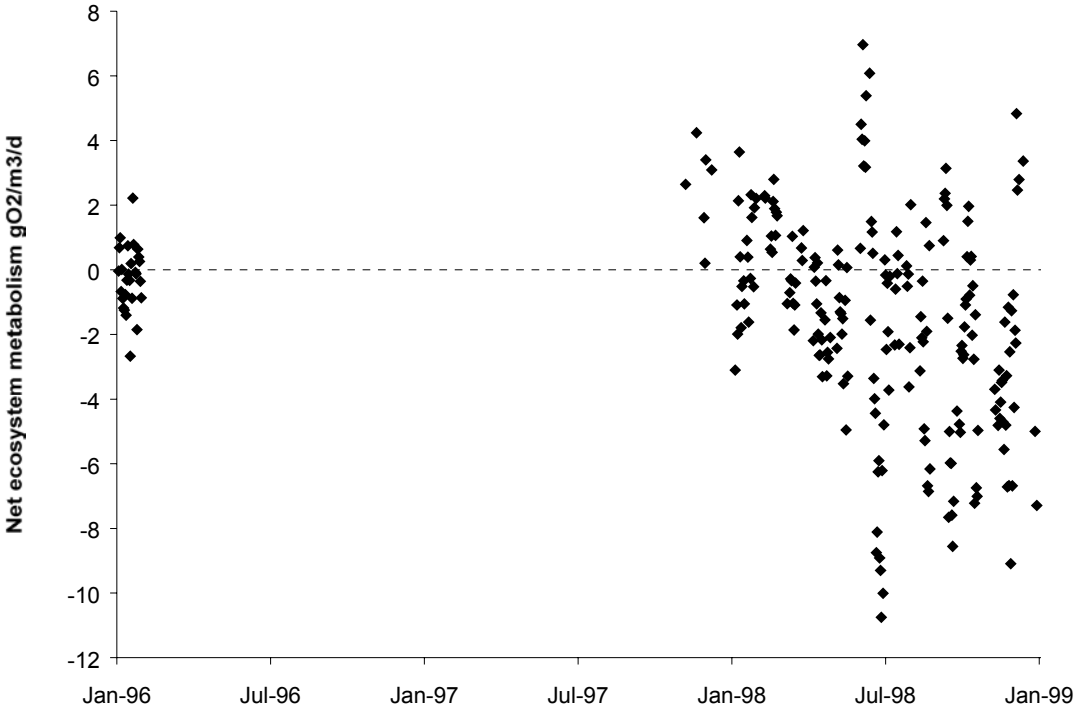


Figure 194. Net metabolism at Weeks Bay, 1996-1998.